came very bright and complete except for the portion below the horizon. It clearly showed red on the inside and blue on the outside. Tangent to this halo, directly above the sun and convex toward it, was a strongly colored arc of a circle, red on the convex and blue on the concave side.

As the sun's altitude increased the parhelic circle gradually extended until it reached nearly around the horizon and the paranthelia 120° from the sun had become very distinct patches of white light. The 22° parhelia meanwhile had become dazzlingly bright, considerably elongated perpendicularly, and showed orange red on the side farthest from the sun. This color arrangement being the reverse of that of the 22° halo seems peculiar.

The phenomena remained visible until about eleven o'clock before which time the 22° halo appeared as a complete circle above the horizon and the parhelion directly below the sun showed brightly. Before vanishing the bright 46° halo and its brilliantly colored tangent arc appeared almost at the zenith.

Measurements of the diameters of the halos and the angular positions of the parhelia were made with an improvised transit. No claim to accuracy can be made for them, both because of the apparatus and because of the bright and diffuse nature of the objects, but the results obtained are practically those given above as was to be expected.

The temperature during the night had been below zero and in the morning was still 3° or 4° below it. The air was quiet and filled with falling crystals of ice.

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## MARKING MICROSCOPE SLIDES

IN the issue of SCIENCE for January 4, Mr. P. A. West gives an aluminum clip method for labelling glass slides while staining which he finds more satisfactory than the diamond pencil or the water-proof-ink method.

With me his objection to a label scratched on the glass does not hold, as I use a jar in which the upper end of the slide is not covered by the stain. I have for several years used an improvised carborundum pencil and have found it most satisfactory.

A fair-sized crystal of carborundum, chosen for one or more sharp points is laid between the two halves of a firm piece of elder pith about an inch and a half long, with the sharp end projecting only sufficiently to make its use easy. Rubber bands are then wound tightly about both ends of the pith, holding the carborundum firmly in place. The pencil may be pointed up by trimming the edges of the pith around the crystal. This pencil is more easily handled than the bare crystal and scratches the data quickly and easily on the slides.

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## SCIENTIFIC BOOKS

*The Organization of Thought.* By A. N. WHITEHEAD, Sc.D., F.R.S., Fellow of Trinity College, Cambridge, and Professor of Applied Mathematics at the Imperial College of Science and Technology. London, Williams and Norgate. 1917. Pp. 219.

This volume is a collection of eight discourses bearing the following titles:

I. The Aims of Education—A Plea for Reform.
II. Technical Education and Its Relation to Science and Literature.
III. A Polytechnic in War-time.
IV. The Mathematical Curriculum.
V. The Principles of Mathematics in Relation to Elementary Teaching.
VI. The Organization of Thought.
VII. The Anatomy of Some Scientific Ideas.
VIII. Space, Time and Relativity.

Except number VII., which is here published for the first time, the articles are addresses delivered before various scientific associations in course of the last four years. The range of discussion is wide, even wider than the diversity of titles might lead one to expect; yet the discussions have a deep unity in the fact that they deal with various aspects of one great matter, the organization of thought, and so the book is happily named. Fresh, direct, trenchant, vital and swift, the style is such as to give the reader more energy

than the reading demands of him, though this demand is not slight.

For whom is the book designed? Those whose acquaintance with Professor Whitehead is confined to his authorship of the "Universal Algebra" and to his joint authorship (with Mr. Bertrand Russell) of the "Principia Mathematica" will be disposed to assume that the present book is designed solely for students of modern logic and the foundations of mathematics. But that assumption would be false. The questions dealt with are large questions of education and of science, and the author is deep enough and circumspect enough to know that no really large question can be merely logical or mathematical or physical or narrowly scientific or philosophical. Accordingly the discussions, while they are of great interest to logicians and mathematicians, are or ought to be of equal interest to psychologists, educators and almost every other type of student and thinker.

The fact just mentioned is strikingly illustrated and confirmed in the final chapter where in dealing with the nature and meaning of time, space and relativity, a first deliberate attempt is made to recognize all the possible ways of approach and to bring into relation with one another the method of the experimental physicist, the method of the mathematical physicist, the method of the experimental psychologist, the method of the metaphysician and the postulational method of the mathematician.

A like commendable catholicity pervades the very suggestive chapter dealing with the anatomy of scientific ideas. This chapter ought to be read in connection with Russell's "Scientific Method in Philosophy." The aim of the two is the same. It is to show a method of *constructing* the fundamental conceptual things—points, atoms, electrons, molecules, etc.—of mathematics and physics (indeed of science in general) out of sense-given data so that we shall not have to be content with *inferring* the existence of such conceptual things but shall *know* their existence as deliberate constructs of our own. Space is lacking to indicate the method here and I must content myself with saying that philosophers, psychologists, logicians and students of natural science, if they do not read the discussion, will miss a great treat.

The title-giving essay, which treats of the organization of thought, is concerned with the relation of logic to science. A thoughtful reading of it will amply repay any one for the trouble, though its full significance can not be appreciated by such as are not acquainted with modern developments in logical theory and especially with its culmination in the above-mentioned "Principia Mathematica." Any reader of Science who happens to know that the author's knowledge of logic has probably never been surpassed will think twice before turning from the following profound and brilliant words closing the chapter in question: "Neither logic without observation, nor observation without logic, can move one step in the formation of science. We may conceive humanity as engaged in an internecine conflict between youth and age. Youth is not defined by years, but by the creative impulse to make something. The aged are those who, before all things, desire not to make a mistake. Logic is the olive branch from the old to the young, the wand which in the hands of youth has the magic property of creating science."

The other essays are concerned primarily with education, secondarily with science. The point of view is fairly well disclosed by a few brief deliverances. "There is only one subject-matter for education, and that is life in all its manifestations." Again: "The devil in the scholastic world has assumed the form of a general education consisting of scraps of a large number of disconnected subjects." What is the cultural value of such scraps? Answer: "A merely well-informed man is the most useless bore on God's earth." What is the right attitude of education towards past, present and future? "No more deadly harm can be done to young minds than by depreciation of the present. The present contains all that there is. It is holy ground; for it is the past and it is the future." Why teach children to solve quadratic equations? "Quadratic equations are part of algebra, and alge-

bra is the intellectual instrument which has been created for rendering clear the quantitative aspects of the world." But are these aspects important? "Through and through the world is infected with quantity. To talk sense is to talk in quantities. It is no use saying that the nation is large,—How large? It is no use saying that radium is scarce,—How scarce? You can not evade quantity. You may fly to poetry and to music, and quantity and number will face you in your rythms and your octaves."

What artist or man of letters has spoken deeper and truer words than the following words spoken by a logician and mathematician regarding style as an aim and test of education? "Finally there should grow the most austere of all mental qualities; I mean the sense for style. It is an esthetic sense based on admiration for the direct attainment of a foreseen end, simply and without waste. Style in art, style in literature, style in science, style in logic, style in practical execution have fundamentally the same esthetic qualities, namely, attainment and restraint. The love of a subject in itself and for itself, where it is not the sleepy pleasure of pacing a mental quarter-deck, is the love of style as manifested in that study. Here we are brought back to the position from which we started, the utility of education. Style, in its finest sense, is the last acquirement of the educated mind; it is also the most useful. It pervades the whole being. The administrator with a sense for style hates waste; the engineer with a sense for style economizes his material; the artisan with a sense for style prefers good work. Style is the ultimate morality of mind. But above style, and above knowledge, there is something, a vague shape like fate above the Greek gods. That something is Power. Style is the fashioning of power, the restraining of power. . . . It is the peculiar contribution of specialism to culture."

Never before have I been tempted in reviewing a book to quote so many of the author's words. I have felt that Whitehead must be allowed to speak for himself. The foregoing quotations are but samples of his manner in dealing with other great questions of science and education. It is my hope that the samples may induce readers of SCIENCE to read the book.

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## SPECIAL ARTICLES

### A PRELIMINARY NOTE ON SOIL MOISTURE AND TEMPERATURE FACTORS IN THE WINTER-KILLING OF GRAIN CROPS

FEW investigations show the relation of kind of soil and moisture to temperature during the winter while none deal with their relation to the winter survival of crop plants. Winter-killing and spring condition of alfalfa, clover, winter wheat, oats, rye, barley, and other crops are very largely dependent on soil temperature during the winter months. These factors have been studied at the Kansas Experiment Station in connection with a general study of the causes of winter-killing of cereal crops.

In the fall of 1914 records were taken of the temperature in three plots of silt loam, to each of which different quantities of water were added during the fall and winter, and on which winter wheat, winter barley, and winter oats were grown. In the fall of 1915 three plots of heavy clay and two of sand were included, there being added to each plot different quantities of water as before. The temperature was recorded at a depth of one inch, three inches and six inches by means of standardized toluol thermometers during the first season, while electric thermometers were used the second. There was no heaving of the soil in either season and the survival of the plants appeared to depend on temperature alone.

The interrelation between the factors studied is very complex, the net resultant varying widely with the degree of variation of the single factors, and also with the character of the season, especially the degree of cold; the duration of freezing weather; the rate of change of air temperature; and the amount of snow. In the first season the lowest temperatures were recorded on the dry plot and the survival of the barley and oats was decidedly less than for the medium wet or the wet plots. The wheat survived practically